THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY.

Devoted to the Interests of Illumination, Heating, Ventilation and Sanitary Improvement, Domestic Economy, and General Science.

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VOLUME XIII.—No. 4. WHOLE No. 256. | NEW YORK, TUESDAY, AUGUST 16, 1870. | $3 PER ANNUM IN ADVANCE.

Wood's Nonpariel Hydrogen and Carburetting Gas Machine.

PATENTED APRIL 5TH, 1870, AND JULY 26TH, 1870.

It has long been a great desideratum to obtain an illuminating agent, combining the advantages of convenience, safety, brilliancy, and economy; and possessed of the further advantage of being applicable in localities remote from fixed supplies of the ordinary coal gas.

The inventive genius of this and other countries has been brought to bear with varying success, to supply this deficiency for the last twenty-five years. The records of these attempts, as set forth in the archives of our Patent Office, affords a striking example of the modifications to which a single idea may be subjected, in order to meet a great public necessity.

Common air, when brought in contact with volatile hydro-carbons, becomes saturated with the vapor given off, and thus impregnated, by combustion gives light. The whole theory and practice of bringing air or *gas* into contact with such hydro-carbons, and utilizing the product, is termed "carburetting."

One hundred and forty different devices have been patented to carburet air, to produce what is commonly called "*air-light*," and all alike in principle, and all fall short of the requirements, viz., a fixed gas, which, like coal gas, will not condense at ordinary temperature, and having sufficient levity or lightness, to travel through pipes with facility, in every direction.

Dr. Joseph S. Wood, of Philadelphia, a gentleman who has given much of his time to scientific investigation, seems to have discovered a solution to the problem. Instead of carburetting air, he produces a fixed gas, or at least its equivalent, by first generating hydrogen gas in a simple apparatus, and then carburetting the same. This is essentially a *carburetted hydrogen*, which is the scientific term applied to coal gas.

Fig. 1.

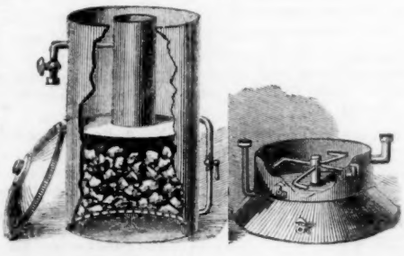


Fig. 2.

NONPARIEL HYDROGEN AND CARBURETTING GAS MACHINE.

The hydrogen forms a semi-chemical union with the carbon of the hydro-carbon, and thus we have a really non-condensable *fixed gas*, having all the qualities of coal gas; but superior, inasmuch as it is entirely free from bad odor, or any impurities, and has a much higher candle power than common gas, and is far less expensive, as will be seen by the appended formula.

FORMULA.

49 lbs. sul. acid, 28 lbs. iron, 9 lbs. water, } will produce

1 lb. hydro gas — 250 c. ft.

This amount of gas picks up, or combines with carbon, making it 4 4-7 times increase in illuminating effect. To be on the safe side of the facts, and to leave plenty of margin, we will call it 300 per cent, making 750 c. ft.

1000 cubic feet in all.

COST.

50 lbs. acid, at 2½ cts. per lb....	$1.25
28 lbs. iron, at 1 ct. per lb.....	28
5 pints gasoline, at 3c. per pint	15
	$1.68

per 1000 cubic feet of gas.

By this exhibit it is shown that for $1.68—1000 cubic feet of illuminating gas is formed: but this gas has 500 per cent. more illuminating effect, or candle power, than ordinary coal gas. It is also free from the sulphur compounds and other impurities always to be found in coal gas, and is therefore more agreeable in its odor; neither do the products of combustion injure gilt ornamentations, picture frames, book bindings, etc., nor are they so deleterious to health.

In fine, this method of making portable gas seems to be the *ultima thule* of invention, in the way of producing an

Fig. 1.

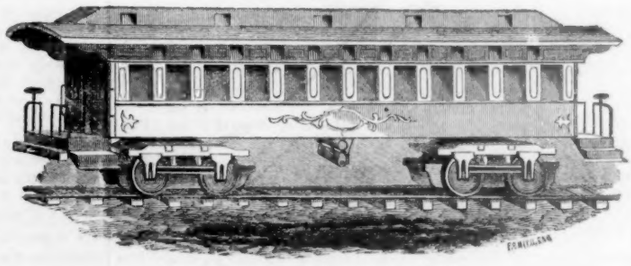


Fig. 2.

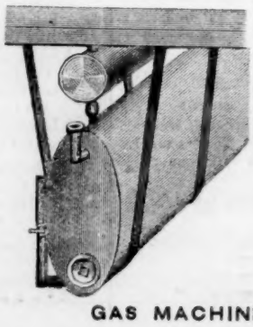
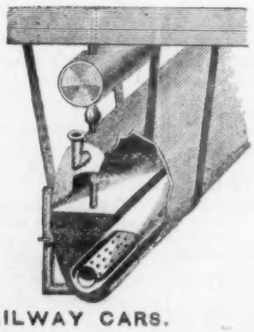


Fig. 3.



GAS MACHINE OR RAILWAY CARS.

exceedingly pure, brilliant, and economical portable gas-light, adapted to the wants of the millions, who would otherwise have to forego the great convenience and luxury of gas light.

Wood's Nonpareil Hydrogen and Carburetting Gas Machines are believed to be the most simple and economical that have been placed before the public, since the introduction of hydro-carbon gas machines for chemical, experimental or illuminating purposes.

The Nonpareil does not contain the dilute acid, iron and hydro-carbon oils in the same machine, and thus avoids the danger and inconvenience all such machines encounter, owing to the excessive amount of heat evolved by the chemical action of the acid and iron, but is so constructed that the carburetting machine can be placed out of the building for convenience or safety, and complying with the rule of the New York Board of Underwriters, who say, all gas machines containing hydro carbon oils must be placed not less than fifty feet from the building, or the carburetting machine must be so walled up and be filled from the outside, or extra insurance must be paid.

The Nonpareil is the only hydro carbon machine that has been invented, that can be placed horizontally beneath railroad cars for illumination.

By it hotels, halls, and private dwellings can be lighted brilliantly at less cost than coal gas. It can be attached to the ordinary gas pipes and fixtures in any building, or the machine for carburetting can be attached to the pipes using coal gas, with a saving of one-third the gas bills, and an increased brilliancy in the lights—a two foot burner giving a light equal to a six foot burner per hour.

Fig. 1 is the upper chamber, containing dilute oil of vitrol, eight parts of water to one of sulphuric acid. Upon opening the cock in (2) the connecting pipe, the acid flows down into the lower chamber, and up through the perforated bottom into (3) the chamber containing the iron. Producing by contact with it pure *hydrogen gas*, which being conveyed through the pipe (4) to the carburetter, there receives its illuminating power, which gives a pure white flame, and equal in photometrical effect to five times that of coal gas.

From this description it will be seen at once that the pressure must be the same upon each burner, whether one or one hundred are burning; for the reason that the faster the gas escapes, the more liquid will run to the iron, and more gas will be generated. But when the burners are turned off, the gas drives the liquid back 1 to the upper chamber, and the generation of gas ceases; for the reason that the gas and liquid cannot occupy the same space at the same time. Thus, we avoid the use of the *gasholder*, and can therefore use the machine under motion, in wagons, railroad cars, steamboats, etc., with perfect safety.

Being automatic in its action by the hydraulic pressure of the liquid, there is no machinery to get out of order, and any coppersmith can make it.

Fig. 2 is a perspective view of a portable apparatus for dwellings, etc.

WOOD'S IMPROVED GAS MACHINE FOR RAILWAY CARS.

This machine is so constructed that it can be placed horizontally beneath railroad cars.

Fig. 1 of the engraving represents the machine applied underneath the floor of a railroad car.

Fig. 2 is an end view of the same enlarged.

Fig. 3 is an interior view of the machine, showing the partition. The upper part is the mixing chamber for the dilute acid, and the lower part is the gas generating chamber.

The carburetting tube (which contains only enough of the hydro carbon oils to vaporize for the above time) is stuffed or packed with sponge, so that it cannot be spilled.

The operation of this machine is as follows: The cap is unscrewed and the perforated tube filled with iron, either cast or wrought; the cap is then replaced and screwed up perfectly tight. The upper tank is now filled with dilute sulphuric acid, which passing down the outer pipe, and acting in the lower chamber, disengages hydrogen gas, which rising to the partition begins to displace the acid and finally forces it all up into the upper chamber, when the iron being no longer in contact with the acid, the gas ceases to generate. The gas now passes up the inner pipe into the carburettor, seen above, when it is ready to distribute through the cars to supply the burners, the same as common gas. When the gas is burned, the acid takes the place of the gas in the lower chamber, and continues to make hydrogen to supply the burner.

State or county rights, and machines for sale, on application to

L. L. McKNIGHT, Agent,
No. 557 Broadway,

The New Bedford Gas Company have declared a dividend of four per cent., and also reduced the price of gas to $3.25 per thousand feet.

Chemical Repertory.--No. 36.

AUGUST 16, 1870.

Editor—HENRY WURTZ.

Editorial.

ORGANIC REMAINS IN "IGNEOUS" ROCKS

C. Montagna writes from Italy, to the President of the French Academy (*Comptes Rendus*, Juin 27, 1870), calling attention to two Memoirs of his own, one published in Turin in 1866, in Italian, on organized remains in rocks called "Azoic," and on the origin of granites; and the other in Naples, in 1869, in French, on a "*New Theory of Metamorphism of Rocks, founded on the phenomena of fossilization of animals and plants of all geological ages.*" He complains of unfair treatment by some Journals, and geological writers, who have, he says, condemned his views, on *a priori* grounds, neglecting and ignoring his *facts*.

Referring to criticisms of Bornemann on Jenzsch's microscopic researches on crystalline rocks, he denies their justice, as his own experience of the petrifaction and mineralization of organic remains, has assured him that "molecular substitutions are fully capable of transforming them repeatedly, and even into crystalline matter in a crystalline medium." In his own case, however, there is no question about microscopic forms, as his specimens were so obviously organic in structure as to be recognizable by the eye, and by unskilled persons; being as distinct as any specimens of carboniferous fossils. Some of the facts brought forward by him, he says, have been recognized, since his last memoir, by the Austrian geologist Wolf, and by de Tchihatcheff. He has many of these specimens at Naples, and invites examination.—H. W.]

[Some extended comments on the above, suggesting applications in American Geology, were projected; but absence has interfered, and the whole must be deferred for the present.—H. W.]

American Chemical News.

[Mr. Farmer having pointed out, in the past records of photometricians, a great number of results which are plainly irreconcilable with any other rule of practice than that which he has originated—was requested by us to put some of his computations on record. He has kindly complied with our request, and gives us some very valuable figures; as follows:—H. W.]

THE FARMER THEOREM.

The following tests and observations, made by eminent men, for the purpose of showing the extraordinary variations in the illuminating power of the same sample of gas when tested under different rates of consumption, and my remarks thereon, may be useful to consumers, and to all who take any interest in the "Farmer Theorem":

Extracts from a Treatise on Gas Works. By Samuel Hughes, C. E., *2rd Edition, page* 289.

An Argand burner, with 25 holes, varies in the following extraordinary manner:

No. 1.	5.	cubic feet consumption	—	12 candles.
2.	3.5	"	"	4.5 "
3.	2.5	"	"	1.2 "
4.	1.5	"	"	0.2 "
5.	1.	"	"	0.02 "

[The following will give the powers or experiments required to raise the last four tests to 12 candles, with five cubic feet consumption:

No. 2.	$3.5^x : 4.5 :: 5^x : 12$	Hence	$x =$	2.75
3.	$2.5^x : 2.3 :: 5^x : 12$	"	$x =$	3.31
4.	$1.5^x : 0.2 :: 5^x : 12$	"	$x =$	3.40
5.	$1.^x : 0.02 :: 5^x : 12$	"	$x =$	3.97

Here the whole of the tests agree much better with the new rule, and the theorem proves that the burner used for the last three tests was not at all suitable; a proper burner would have given No. 3 test with 2.5 cubic feet consumption — 3 candles, No. 4 with 1.5 cubic feet — 1.08 candles, and No. 5 with one cubic foot — 0.48 candle.—W. F.]

"The other burners follow the same law; for instance, a fishtail with

No. 1.	5	cubic feet consumption	—	10 candles.
2.	3.5	"	"	— 5.5 "
3.	2.5	"	"	— 2.4 "
4.	1.25	"	"	— 0.6 "

[The following will give the power or exponents required to raise the last three tests to 10 candles, with 5 cubic feet consumption:

No. 2.	$3.5^x : 5.5 :: 5^x : 10.$	Hence	$x =$	1.69
3.	$2.5^x : 2.4 :: 5^x : 10.$	"	$x =$	2.05
4.	$1.25^x : 0.6 :: 5^x : 10.$	"	$x =$	2.02

Here again they all come much nearer the new rule; and the last two tests, we may say, are in accordance.—W. F.]

Extracts from the *Gas Consumers Guide.* By William Richards, C. E.

"I will now refer to the varied light obtained by the adjustment of flames, which is another source of loss.

"We would naturally suppose that in proportion to the quantity of gas issuing from a burner, so would be the amount of light obtained; thus, if 5 feet give the light of 12 candles, that the flame being reduced so as to consume 2½ feet, would give the light of 6 candles. This, however, is far from being the case, for there is a particular point in the consumption of any class of burners where the maximum light is derived, and any deviation from this entails loss. As an example of this, if an Argand flame consumes 5 feet per hour, and gives the light of 12 candles and this be reduced so that only three-fourths of that quantity is burned, then instead of the light being equal to nine candles, the theoretical proportion, it will be six candles only, causing a direct loss of 36 per cent, and if the flame is further reduced to consume 2½ feet, then instead of the light being that of six candles (the due proportion according to consumption), it will be 2½ candles, being a loss of nearly 60 per cent."

[The above examples reduced by the two rules:

No. 1.		5	ft. consumpt. —	12 candles
2.	¾ of 5 ft. —	3.75	"	6. "
3.		2.5	"	2.25 "

No. 2. By the new rule $5^2 : 12 :: 3.75^2 :$ 6.75 candles
" " old rule 5 : 12 :: 3.75 : 9. "

The new rule has brought it much nearer to the actual illuminating power of six candles than the old rule, which reduced it only to nine candles, or 50 per cent. too much.

No. 3. By the new rule $5^2 : 12 :: 2.5^2 :$ 3 candles
" " old rule 5 : 12 :: 2.5 : 6 "

Hence here also the new rule has brought it much nearer to the actual illuminating power of 2½ candles, the old rule giving six candles, or 166 per cent. too much.

The power or exponent required to reduce both these tests, Nos. 2 and 3, is 2.41.—W. F.]

"Thus the cost of light from gas is very much increased by reducing the size of the flame. The knowledge of this fact is of importance to the consumer, who, in ignorance of it, in his desire to be economical, might obtain directly the opposite result. To give an instance of this, let us observe a shop front window having four good Argand burners, as described, but their flames so checked or adjusted as to consume each 2½ feet per hour, when the light from them conjointly would be only equal to 10 candles, obtained at a cost of 10 feet of gas per hour; whereas, if these were replaced by one burner with the flame at the proper height, considerably more light would be had at one half the cost. Here, then, is one of the many remarkable instances where consumers voluntarily increase their gas accounts by improper management."

[The above is exactly in accordance with the new rule; for according to the new theorem one Argand burner consuming 5 cubic feet per hour, should give a light equal to 4 good burners consuming conjointly 10 cubic feet of gas per hour.—W. F.]

"Whenever economy in gas, and a good light are desirable, the larger descriptions of batswing burners are always to be preferred, as reference to the following table, of the light given by various kinds, will demonstrate. The letters attached are for future observations—

A. A batswing burner consuming 2 feet per hour gives the light of 2½ candles.

B. A batswing burner consuming 2½ feet per hour gives the light of 3½ candles.

C. A batswing burner consuming 3½ feet per hour gives the light of 6. candles.

D. A batswing burner consuming 4½ feet per hour gives the light of 10. candles

E. A batswing burner consuming 6 feet per hour gives the light of 15½ candles.

F. A batswing burner consuming 7½ feet per hour gives the light of 22 candles.

[The following will give the powers or exponents required, to reduce the last five tests, when compared with the 1st, viz., 2 cub. ft. consumption — 2.25 candles.

$2.^x : 2.25 :: 2.5^x : 3.5$	Hence	$x =$	1.98
$2.^x : 2.25 :: 3.5^x : 6.$	"	$x =$	1.75
$2.^x : 2.25 :: 4.5^x : 10.$	"	$x =$	1.84
$2.^x : 2.25 :: 6^x : 15.5$	"	$x =$	1.75
$2.^x : 2.25 :: 7.5^x : 22.$	"	$x =$	1.72

All these tests are much nearer in accordance with the theorem.—W. F.]

"Following the law of other burners for the light produced, the larger descriptions of fishtails are the most economical, as seen by the subjoined.

A. A fishtail burner, consuming 1½ feet per hour, gives the light of 1 candle.
B. A fishtail burner, consuming 2½ ft. per hour, gives the light of 2½ candles.
C. A fishtail burner, consuming 3½ ft. per hour, gives the light of 3½ candles.
D. A fishtail burner, consuming 4½ ft. per hour, gives the light of 10 candles.
E. A fishtail burner, consuming 5 feet per hour, gives the light of 12½ candles.
F. A fishtail burner, consuming 7 feet per hour, gives the light of 18 candles.

[The following will give the powers or exponents required to reduce the last four tests, when compared with B, viz., 2½ cub. feet consumption — 2.75 candles.

$2.5^x : 2.75 :: 3.5^x : 6.5$ Hence $x = 2.55$
$2.5^x : 2.75 :: 4.5^x : 10.$ " $x = 2.18$
$2.5^x : 2.75 :: 5^x :: 12.6$ " $x = 2.18$
$2.5^x : 2.75 :: 7^x :: 18.$ " $x = 1.71$

Here again the whole of these tests come much nearer to the 2nd power, than to simple ratio. The one fishtail consuming 5 cubic feet of gas per hour, gives rather more light than four fishtails, each consuming 2½ cubic feet, or conjointly, 10 cubic feet per hour.—W. F.]

"Therefore, in order to employ gas advantageously, the larger size burners should always be adopted, even when only the limited light of two or three candles is required. The larger burner when turned down to the proper degree, furnishes that light at a much more economical rate than the smaller kinds.

"Nevertheless we see in daily practice, establishments such as taverns, illuminated by the smallest description of burners, frequently arranged in clusters or bouquets. The light obtained from these is always of a dull nature, and most extravagant in price. To demonstrate this I would take a case in point, a tavern, for instance, having a series of bouquets of fishtails A, one hundred of which are distributed throughout the premises (by no means uncommon), giving the light of 100 candles, at a cost of 125 cubic feet per hour. Now, if instead of these, only eight burners, E, were employed, then precisely the same quantity of light would be had, at about one third the cost."

[This last example, reduced by the new rule, viz., If 100 small burners, consuming 125 cubic feet of gas per hour, give a light equal to 100 candles, how many cubic feet of gas will eight burners require to give the same candle power?

Each of the small burners consumes $\frac{125}{100}$ or 1.25 cub. feet of gas per hour, and gives a light equal to one candle, and each of the eight large burners must give a light equal $\frac{100}{8}$ or 12.5 candles.

Let x = The consumption of gas required by each of the 8 large burners

$$1.25^2 : 1 :: x^2 : 12.5$$
$$x^2 = 19.53125$$
$$x = 4.419 \text{ cubic foot.}$$

And $4.419 \times 8 = 35.35$ cubic feet of gas required for the 8 burners conjointly, to give a light equal to 100 candles.

This is very nearly in accordance with Mr. RICHARDS'S calculations.

In conclusion, I must beg, that every one who takes interest in this matter, will read this and another paper, lately published in the GAS LIGHT JOURNAL, carefully; and then I am sure he will be convinced that all photometrical observations taken, when consuming more or less than the normal quantity of gas, can be reduced much nearer to the real candle power by the FARMER theorem, than by any other method yet introduced. It is remarkable also, that I cannot find one single test in either HUGHES, RICHARDS, or SUGG, that can be reduced by the rule of three.

WILLIAM FARMER.

NEW YORK, August 8, 1870.

VETERA RESUSCITATA.

The above heading is one which might very readily have a special column appropriated to it, a column which could be easily kept well filled, with matter of a sort, not merely curious and interesting, but highly profitable.

The example which I am enabled to furnish below, being obviously in point, needs for present explanation merely the remark, that its discovery was the result of a search made during the last week, in the truly magnificent scientific library of the United States Patent Office, at Washington. This library, under its present administration, by Professor GEO. C. SCHAEFFER, has been brought to a condition of completeness which ought to be generally known to American scientists. In fact, it is the only library in which the present writer finds it practicable to accomplish a satisfactory scientific search; that is in which the courtesies and facilities are extended that are requisite to such a search. This seems a hard thing to say, but true. I can add that Prof. SCHAEFFER'S *complete* sets of *Indexes* of the Scientific Literature of all past time, enabled me on the spot to assure myself that, strange as it is, there are absolutely *no other references* to these forgotten results of DOEBEREINER than these I have given here.—H. W.

From the *Bibliotheque Universelle*, Nov., 1831; also in Silliman's *Am. Journal of Science*, volume xxii, page 352, 1832.

[Taken from the *Jahrbuch für Chemie und Physik*, SCHWEIGGER'S Jahrbruch, vol. 72.]

Splendid Combustion of H gas under strong compression; by Prof. DOEBEREINER.—H gas, under common pressure, burns both in atmospheric air and oxygen gas, with a feeble and scarcely visible flame. The flame becomes more brilliant only when brought into contact with a more solid substance, susceptible of becoming red hot, such as platinum foil, oxide of zinc, lime, magnesia, etc. DAVY infers from phenomena of this sort, that the brilliancy of all flame is owing to the presence of a solid incandescent substance, which is formed or disengaged during combustion, and that a gaseous substance never can be heated so as to emit a vivid light.

The cause of these opposite phenomena may be found in the different modes by which heat acts upon various substances; elastic fluids and volatile substances expand by caloric and disperse it, while solid bodies resist the repulsive action, and absorb and condense the heat so as to become luminous.

But, if this view be correct, gaseous substances, disengaged by combustion, ought, when forcibly restrained from expansion, to exhibit incandescence and splendor. An experiment, at once simple and brilliant, confirms the justness of this conclusion.

If a mixture of two volumes of hydrogen and one of oxygen be confined in a strong globe of one or two cubic inches in capacity, *perfectly* dry internally, and well closed, and then kindled, it burns with as brilliant a light as that of phosphorus in oxygen gas. If the detonating gas be compressed into the globe to two atmospheres, it emits, when kindled, the splendor of lightning. Even in open day, the effect is like that of the most vivid lightning; and by night, it is so much like a burst of sunshine, that oyster shells heated with sulphur become phosphorescent when exposed to it. If there be moisture in the globe, or if the cock be left open, the light is very feeble, because in the first case the light is absorbed by the moisture, and in the second, dispersed by the sudden exhaustion.

The kindling of the explosive mixture is best effected by the electric spark. * * The wires of such an apparatus should approach the nearer as the gas is more compressed, for the spark in condensed gases will not pass through so great a space.

The facts induce the author to seek for the cause and condition of the brilliancy of flame, not in the presence of solid, incandescent matter, but in the forcible accumulation or condensation of caloric, and he thinks it not hazarding too much to propose this point of view as a photological axiom. He has not examined the luminous effect of burning, in this manner, gases, which by combustion with oxygen, give permanently elastic products. It is rare to find globes of glass strong enough, and of uniform resistance. Tubes are not suitable, as they present too large a surface, and consequently absorb too much heat.

Another item, of a cognate character, is taken from DOEBEREINER on the same page, which I shall also copy.

"*Chemical Agency of Light.*—A series of experiments on the relations of oxalic acid to metallic oxides, induced DOEBEREINER to draw the inference that the chemical influence of light is very rarely analogous to that of heat, and that it is *sui generis*; that the one determines a contraction, the other an expansion, of the matter, and that the reductive action of light is a consequence of the contractive force of that agent, while the effect by which heat promotes combustion and almost every kind of chemical penetration, is the result of the dilatation of the matter occasioned by it. The cause of that opposition of effect is unknown, and we can scarcely hope to discover it, when we reflect with what facility light is transformed into heat, and *vice versa*."—H. W.]

The Chemical History of a Candle.

BY PROFESSOR FARADAY.

[A course of Six Lectures delivered before the ROYAL INSTITUTION of Great Britain.]

LECTURE II.

A CANDLE; BRIGHTNESS OF THE FLAME—AIR NECESSARY FOR COMBUSTION—PRODUCTION OF WATER.

I want you now to follow me on this point—that whenever a substance burns, as the iron filings burnt in the flame of gunpowder, without assuming the vaporous state—they may become liquid or they may remain solid—they become exceedingly luminous. I have here taken three or four cases away from the candle, on purpose to illustrate the point to you; because what I have to say is applicable to all substances, whether they burn or whether they do not burn, that they are exceedingly bright if they retain their solid state, and that it is to this presence of solid particles in the candle that it owes its brilliancy.

Here is a platinum wire which does not change by heat. If I heat it in this flame, see how exceedingly luminous it becomes. I will make the flame dim for the purpose of giving a little light only, and yet you will see that the heat which it can give to that platinum wire, though far less than the heat it has itself is able to raise the platinum wire to a far higher state of effulgence. This flame has carbon in it; but I will take one that has not carbon in it. There is a material, a kind of fuel—a vapor, or gas, whichever you like to call it—in that vessel, and it has no solid particles in it; so I take that because it is an example of flame itself burning without any solid matter whatever; and if I now put this solid substance in it, and you see what an intense heat it has, and how brightly it causes the solid body to glow. This is the pipe through which we convey this particular gas, which we call hydrogen, and which you shall know all about the next time we meet. And here is a substance called oxygen, by means of which this hydrogen can burn; and although we produce, by their mixture, far greater heat than you can get by the candle, yet there is very little light. If, however, I take a solid substance, and put that into it, we get a great light. If I take a bit of lime, which is a thing which will not burn, and which will not vaporize by the heat, and because it does not vaporize remains solid and remains heated, you will find what happens as to the glowing of it. I have a most intense heat here produced by the burning of the hydrogen in contact with the oxygen; but as yet there is very little light—not for want of heat, but for want of particles which can retain their solid state; but when I hold this piece of lime in the flame of the hydrogen as it burns in the oxygen, see how it glows! This is the glorious lime light which rivals the voltaic light, and which is almost equal to the sunlight. I have here a piece of carbon or charcoal which will burn and give us light exactly in the same manner as if it were burnt as part of a candle. The heat that is in the flame of a candle decomposes the vapor of the wax and sets free the carbon particles; they rise up heated and glowing as this now glows, and then enter into the air. But the particle when burnt, never pass out from a candle in the form of carbon. They go off into the air as a perfectly invisible substance, about which we shall know hereafter.

Is it not beautiful to think that such a process is going on, and that such a dirty thing as charcoal can become so incandescent? You see it comes to this—that all bright flames contain these solid particles; all things that burn and produce solid particles, either during the time they are burning, as in the candle, or immediately after being burnt, as in the case of the gunpowder and iron filings, all these things give us this glorious and beautiful light.

I will give you a few illustrations. Here is a piece of phosphorus, which burns with a bright flame. Very well; we may now conclude that phosphorus will produce, either at the moment that it is burning or afterwards, these solid particles. Here is the phosphorus lighted, and I cover it over with this glass for the purpose of keeping in what is produced. What is all that smoke? That smoke consists of those very particles which are produced by the combustion of the phosphorus. Here again are two substances. This is chlorate of potassa, and this is sulphuret of antimony. I shall mix these two things a little, and then they may be burnt in many ways. I shall touch them with a drop of sulphuric acid, for the purpose of giving you an illustration of the chemical action, and they will instantly burn. [The lecturer here ignited the mixtnre by means of sulphuric acid.] Now, from the appearance of things, you can judge whether they produce solid matter in burning. I have given you the train of reasoning which will enable you to say whether they do or not. And what is this bright flame but the solid particles passing off.

Mr. Anderson has in the furnace a pretty hot crucible—I am about to throw into it some zinc filings, and they will burn with a flame like gunpowder. I make this experiment because you can make it well at home.

Now, I want you to see what will be the result of the combustion of this zinc. Here it is burning—burning beautifully like a candle, I may say. But what is all that smoke, and what are those little clouds of wool which will come to you if you cannot come to them, and make themselves sensible to you in the form of the old philosophic wool, as it was called? We shall have left in that crucible, also a quantity of this woolly matter. But I will take a piece of this same zinc and make an experiment a little more closely at home, as it were. You will have here the same thing happening. Here is a piece of zinc; there [pointing to a jet of hydrogen] is the furnace, and we will set to work and try and burn the metal. It glows, you see; there is the combustion; and there is the white substance into which it burns. And so if I take a flame of hydrogen as the representative of a candle, and show you a substance like zinc burning in the flame, you will see that it was merely during the action of combustion that this substance glowed—while it was kept hot; and if I take a flame of hydrogen and put this white substance from the zinc into it, look how beautifully it glows, just because it is a solid substance.

I will now take such a flame as I had just now and set free from it the particles of carbon. Here is some camphene, which will burn with a smoke, but if I send these particles of smoke through this pipe into the hydrogen flame, you will see that they will burn and become luminous, because we heat them a second time. They are there. Those are the particles of carbon re-ignited a second time. They are those particles which you can easily see by holding a piece of paper behind them, and which, whilst they are in the flame are ignited by the heat produced, and when so ignited produce this brightness. When the particles are not separated you get no brightness. The flame of coal-gas owes its brightness to the separation, during combustion, of these particles of carbon, which are equally in that as in a candle. I can very quickly alter that arrangement. Here, for instance, is a bright flame of gas. Supposing I add so much air to the flame as to cause it all to burn before those particles are set free, I shall not have this brightness; and I can do that in this way:—If I place over the jet this wire gauze cap, as you see, and then light the gas over it, it burns with a non luminous flame, owing to its having plenty of air mixed with it before it burns; and if I raise the gauze up you see it does not burn below. There is plenty of carbon in the gas; but because the atmosphere can get to it and mix with it before it burns, you see how pale and blue the flame is. And if I blow upon a bright gas flame, so as to consume all this carbon before it gets heated to the glowing point, it will also burn blue. [The lecturer illustrated his remarks by blowing on the gas light.] The only reason why I have not the same bright light when I thus blow upon the flame, is that the carbon meets with sufficient air to burn it before it gets separated in the flame in a free state. The difference is solely due to the solid particles not being separated before the gas is burnt.

You observe that there are certain products as the result of the combustion of a candle, and that of these products one portion may be considered as charcoal or soot: that charcoal, when afterwards burnt, produces some other product; and it concerns us very much now to ascertain what that other product is. We showed that something was going away: and I want you now to understand how much is going up into the air; and for that purpose we will have combustion on a little large scale. From that candle ascends heated air, and two or three experiments will show you the ascending current; but in order to give you a notion of the quantity of matter which ascends in this way, I will make an experiment by which I shall try to imprison some of the products of this combustion. For this purpose, I have here what boys call a "fire balloon." I use this fire balloon merely as a sort of measure of the result of the combustion we are considering; and I am about to

make a flame in such an easy and simple manner as shall best serve my present purpose. This plate shall be the "cup," we will say, of the candle; this spirit shall be our fuel; and I am about to place this chimney over it, as it is better for me to do so than to let things proceed at random. Mr. Anderson will now light the fuel, and here, at the top, we shall get the results of the combustion. What we get at the top of that tube is exactly the same, generally speaking, as you get from the combustion of a candle; but we do not get a luminous flame here, because we use a substance which is feeble in carbon. I am about to put this balloon—not into action, because that is not my object, but to show you the effect which results from the action of those products which arise from the candle as they arise from the furnace. [The balloon was held over the chimney, when it immediately commenced to fill.] You see how it is disposed to ascend; but we must not let it up, because it might come in contact with those upper gas-lights, and that would be very inconvenient. [The upper gas lights were turned out at the request of the lecturer, and the balloon was allowed to ascend.] Does not that show you what a large bulk of matter is being evolved? Now there is going through this tube [placing a large glass tube over a candle] all the products of that candle, and you will presently see that the tube will become quite opaque. Suppose I take another candle and place it under a globe, and then put a light on the other side, just to show you what is going on. You see that the sides of the jar become cloudy and the light begins to burn freely. It is the products, you see, which make the light so dim, and this is the same thing which makes the sides of the jar so opaque. If you go home and take a spoon that has been in the cold and hold it over a candle—not so as to soot it—you will find that it becomes dim just as that jar is dim. If you can get a silver dish, or something of that kind, you will make the experiment still better; and now, just to carry your thoughts forward to the time when we shall next meet, let me tell you that it is *water* which causes the dimness, and when we next meet I will show you that we can make it, without difficulty, assume the form of a liquid.

On Setting and Working Retorts.

(*Continued from page* 52.)

Of the three kinds of fire-clay vessels used in gas-works, viz., brick ovens, brick retorts, and ordinary retorts in whole lengths, or in convenient lengths for jointing together—their efficiency, I think, may be taken in the inverse order here given. Brick ovens, if justifiable at all, can only be so, it seems to me, where coals are very cheap, and coke valueless. They are beyond all doubt the most inefficient appliances for gas-making, and although highly creditable to the inventor, as being a great advance on the processes then in use by introducing fire-clay as a substitute for iron, are surely inexcusable now. Everything is against their use except durability, which might have been some plea in their favor when retorts cost from 10s. to 12s. per foot run, but now when they can be obtained, in a greatly improved condition to what they were in those days, at less than half these prices, it seems to me that this, their only recommendation, is obtained at a ruinous price. They do not make so much gas per ton of coal carbonized as retorts do; they do not produce the same quantity of gas in the same retort-house floor area that good settings do; they are wasteful in drawing and charging; and the fuel required to get at all a satisfactory production of gas from the coal is enormous. I do not think there will be any exaggeration in saying that the oven system requires at least 25 per cent. more coke for fuel than suffices for retorts in fairly average settings, to produce an equal quantity of gas, and I have heard of cases where considerably more even than that was used. But taking the extra coke required for an oven over a bed of retorts at but 20 per cent. by measure, and assuming that such a setting of retorts requires a chaldron of coke per 12 hours, equal to 24 sacks—say 25 cwt. per 24 hours—and reckoning the selling price of coke at but 10s. per ton, there is a loss in money value of 17s. 6d. per week, sufficient to renew a bed of seven retorts at £6 per retort every eleven months; so that apart from the other serious evils of the oven system, this economy of duration theory utterly breaks down. In this comparison I have taken fair average settings, and I believe, put everything favorable for the ovens. If the comparison be made with settings that make more gas per retort, and with a considerably greater economy of fuel than here given, the case is, of course, still worse for the ovens. Nobody who wants to generate steam quickly would now think of applying heat merely to the outside of a boiler of large diameter. To attain that object flues are made through the boiler, so that the mass of water to be acted on is broken up and brought into more direct contact with the heat applied, and one would think that a little reflection would show that the same principle should be applied to the vessels used for the generation of gas. The oven is the boiler without flues; a bed of retorts is the boiler having a number of flues. In the one case the flues heat in the surrounding medium; and it seems to me that using ovens for distilling coal is only less absurd in degree than would be the employment of an old-fashioned wagon boiler for generating steam quickly.

Next in order, and in my opinion occupying an intermediate place in utility between the antiquated brick oven and the modern clay retort, comes the brick-built retort. The advocates of these retorts, like those of the ovens, fairly claim for them a greater durability than the ordinary retort; but when this has been conceded, it seems to me that nothing more can be said of their superiority, while in some points they are certainly inferior to the ordinary retorts. The question is not merely whether a setting of brick retorts lasts longer than a setting of the ordinary clay ones, but which of them, all things considered, are on the whole the more advantageous. The first cost of a setting of these brick retorts, and the annual cost of repairs, are as nearly as possible the same as for the setting of ordinary retorts of the same number and capacity, but their duration (with the renewal of the retort over the fire in a bed of seven) extends, I am informed, to four years, or a little over, contrasting favorably in this respect with ordinary clay retorts. The production of a D-shaped retort, 15 by 13 inches, and 9 feet 9 inches long, or 19 feet 6 inches from mouth to mouth of a through retort, is 5000 cubic feet per mouthpiece per 24 hours from Newcastle coals with the usual admixture of cannel. These particulars have been given to me for this paper by a member of this association, who is the engineer of very large works where these retorts are used; and you may take it that his results are the most favorable possible with this class of retorts, because the establishment with which he is connected is one of the best managed and most successful in the kingdom. The objectionable thing about these settings—viz., the fuel they require—outweighs, in my opinion, the advantage of their greater durability. They require 28 to 30 per cent. of fuel, as usually reckoned, or, in other words, every 100 tons of coal carbonized requires the consumption of 28 to 30 chaldrons of coke. But this is about 8 to 10 per cent. more than is in some works found necessary for similar settings of ordinary retorts, and at least twice what suffices for settings of seven oval retorts arranged as shown on the drawings exhibited, and which in the ordinary every-day of working produce from 10 to 15 per cent. more gas than the brick retorts do. Now, assuming the extra fuel required over settings of ordinary retorts to be but three sacks of coke for each five per 12 hours—six sacks per 24 hours, there is thus for each through bed an extra consumption of a chaldron per 24 hours. This, at say 7s. 6d. per chaldron, amounts to £2 12s 6d. per week—sufficient to renew the retorts every 8 months. Or, taking the life of ordinary retorts at two years, the saving in fuel alone in that time would not only pay for the renewal of the entire setting but would leave a surplus in addition of £189, being nearly £100 per annum per through bed of retorts. In this estimate I believe the disadvantage in this respect of the brick retort system to be rather understated than otherwise, but if only half the above amount be taken as correct, there would, over and above renewing the retorts, be still a loss for fuel alone over ordinary clay retorts of about £50 per through bed per annum. It is true that in many places the fuel for ordinary settings is as heavy, and in some instances even heavier, than that her given for brick retorts, but that only denotes want of time, or attention, or skill on the part of those having the management of the carbonizing. In these cases the evil can be cured, if the proper means be adopted; but with settings of brick retorts I do not think any appreciable improvement can be made on the above results.

The degree of success in carbonizing with clay retorts depends on several conditions, but chiefly on the following, viz., on the quality of the retorts, on their form, on the degree of skill exercised in setting them, and on the way in which they are worked and used. That "the best is the cheapest" is a maxim especially applicable to a retort, and it is hardly necessary to say that its worth depends both on the quality of the clay of which it is made, and on the mode of manufacture. I prefer a well-burnt retort, even although it may detract a little from its finished appearance. Retort manufacturers are often sadly pushed for time in the execution of the orders sent to them, and it is hardly, therefore, to be wondered at if retorts are sometimes delivered in but a semi-baked condition, requiring the gas companies that use them to do work that should be done before being delivered, thus giving the makers additional kiln room, and lessening their fuel and labor accounts. The form of the retort is a material element as regards both its durability and the facility of working it. The nearer the circular, the greater the strength; the less unequal is the expansion and contraction; the less injuriously is the retort affected by the furnace flame; and the greater ease is there in drawing the charge. Next to the square or oblong section, the D shape—for which there seems to be an unaccountable preference, especially in country gas-works—is the very worst. The unequal contraction and expansion, owing to the corners of the retort, is alone sufficient to condemn it. But even that is unimportant compared with the rapid destruction of retorts of this form owing to the corners getting burnt away. This evil effect is so obvious that it hardly requires mentioning, and I hope this meeting will be favored with some more satisfactory reason for continuing their use than has hitherto been advanced. The natural result of the use of

this kind of retort is seen in the recently published "Gas Manager's Handbook," by Mr. Newbigging,* where the duration of an ordinary D clay retort is given as equal to the production of about a million and a half cubic feet of gas. Now, if this statement is anything like reliable, and I see no reason to doubt its accuracy, I have no hesitation in saying that such working is simply playing at gas making. Respecting the facility of drawing and charging, any stoker who has worked round or oval and D retorts will tell you that he would as soon draw three of the for er as two of the latter. In the round or oval shapes the coke slides into the centre of the retort and to the drawing-rake, whereas with retorts of the D shape a portion falls away into the corners, requiring the more frequent insertion of the rake, and consequently additional time and labor. In addition to the form of the retorts and the arrangement of their setting, a good deal depends, both as regards the economy of fuel and the duration of the retorts, on the way they are worked and managed. The minimum draught requisite to keep them sufficiently hot must be ascertained by gradually opening or closing the damper until the proper draught be ascertained, and this should not afterwards be exceeded. Again, a good deal depends on the skill in repairing the retorts. I have seen retorts condemned as worn out that might have been easily repaired by a little contriving, such as the shifting, or adding, of an arched ring or two to form a backing against the bad places, that could have been done at a trifling cost, and would have made the retorts equal to another season's work.

In the arrangements for working the retorts it used to be customary to draw and charge a whole bed at once. I do not know whether this is still done anywhere; if so it would be found advantageous to abandon the practice. The result is the lowering of the temperature of the retorts to a greater degree than when only a part of the setting is charged, and this, too, at the time it is most required to be kept up. A convenient way is to reciprocally charge half the number of retorts in the bed when the charge in the others is half off. There not being then such a rapid absorption of the heat by the retorts containing the half-spent charge, the fresh charged ones get the benefit, and thus a kind of self acting adaptation of the heat to the condition of the charge is effected, and better results, both as to quantity and quality of the gas, produced. It is true that the injurious effect of charging a whole bed at once does not hold good to the same extent with clay as with iron retorts. Still it is an evil, and is just one of those apparently unimportant details, the due attention to or neglect of which go far towards accounting for the greater or less success of any industrial pursuit. There is the less reason, too, for this custom, because its abandonment entails no additional labor or inconvenience, but is, on the contrary, especially where the scoop is used, a matter of convenience and comfort. I have understood that Mr. Kirkham, when engineer-in-chief of the Imperial Gas Company, was the first to abandon the old and defective system of working retorts.

There are three conditions in retort-setting essential for their successful working, viz., First, to so arrange the course of the furnace gases that heat will be imparted, not only to all the retorts in the bed, but also to the whole length of each retort as nearly as possible alike; second, that the brick work be so contrived as to give the required support to the retorts at the greatest number of points, with as little actual covering of the retorts as possible, and without interfering with the free play of furnace flame; and, third, that the retorts be set sufficiently close together. When these conditions are thoroughly understood, Newcastle gas coal may be carbonized without any difficulty, with an expenditure of coke for fuel not exceeding 10 to 15 per cent. in the usual way of computing such account, and with the production of from 38,000 to 40,000 cubic feet of gas per 24 hours on a retort-house floor of 81 feet super., including division walls between the ovens in which the retorts are set; or, in other words, in an arch 7 feet 6 inches wide by 9 feet long, with 18 inch division, or party wall. Round and oval retorts need not, and ought not to exceed three inches in thickness; and I may here parenthetically observe that this is one of the advantages of having retorts of these forms When the strength or resisting power of the retorts is diminished by their having angles, it is usually found necessary to have them made 4 inches or even 4½ inches thick. The retorts I prefer are 3 inches thick, with an additional inch at the swell or flange at the mouth, for the mouthpiece bolts, and they are set with the flanges touching all round, which leaves 2-inch flue spaces between them. By this means the furnace gases are, so to speak, squeezed into a thin sheet, and are thus elongated in the lengthway of the retorts, and, spreading over and rubbing against the retorts, are readily deprived of their caloric. It is often considered one of a gas manager's chief difficulties to keep his retorts hot, and not without reason as retorts are sometimes set They do not get a chance of heating with an ordinary consumption of fuel. In cricket parlance, the stumps are set so wide apart that there is no getting the balls off, and unnecessarily large balls have to be resorted to in consequence. As one having paid considerable degree of attention to this question of retort setting I would respectfully counsel "wide-stumped" gentlemen, should there be any present, just to make one trial of moving their "stumps" a little closer. The products of the furnace, like those of the retorts, will pass where there is least resistance, and the great bulk will find their way to the chimney unused if the retorts are too far apart, so that one of two things must happen—either the retorts are not properly heated, or an excessive volume of furnace gases must be passed through the bed to effect that end, requiring, of course, an unnecessary consumption of fuel. As to the way in which these products pass through the bed, it will be found that making them pass alternately up and down is more effectual than what is called a "running heat," that is, playing longitudinally. Where there is a retort placed over the furnace, as in some of the drawings exhibited, it is sometimes found difficult to prevent the protecting arch from dropping. This is a difficulty that need never occur if bricks be used that will stand the heat. The reason is simply bad workmanship—too thick joints and the bricks not properly rubbed together. This, at any rate, ought to be an unknown difficulty where the red Ewell bricks are used, because, being as friable as a household bath brick, they can be easily rubbed surface to surface, and the arch built without the employment of any cement at all, if preferred, and being composed largely of silica, they are infusible by the greatest furnace heat.

[To be continued.]

* This work can be had of D. Van Nostrand; see advertisement on page 59.

Quality of the Gas Supplied to the City of London.

Dr. Letheby, the Chief Gas Examiner for the Metropolis, has recently reported to the Corporation, and to the Metropolitan Board of Works, on the quality of the gas supplied to the Metropolis by the Chartered, the Great Central, and the City of London Gas Companies. The average illuminating power of the gas, when burnt at the rate of five cubic feet per hour from Sugg's improved Argand burner has been as follows:—The common gas of the City Company has been equal to 17·55 standard sperm candles; that of the Chartered Company, at Leadenhall Street, has been 17.44 candles, at Gray's Inn Lane, 16·92 candles; at Arundell Street, Haymarket, 17.14 candles; and that of the Great Central Company, 17.82 candles The illuminating power of the Cannel gas of the Chartered Company has been 24.44 candles, and of the City Company 28 candles. As regards impurity, Dr. Letheby reports that the gas of all the companies has been constantly free from sulphuretted hydrogen, although the amount of sulphur in other form than the last named, has varied considerably; for while it amounted to an average of only 12. 29 grains per 100 cubic feet of the Great Central gas, and 12.71 grains per 100 feet of the Cannel gas from the City Works, it reached 22·18 grains, 22.39 grains, and 29.65 grains in the gas of the Chartered Company at the three testing stations of Leadenhall Street, Gray's Inn Lane, and Arundell Street. In connection with this important part of the subject, Dr. Letheby reports that the testing of the gas of the several companies for sulphur, during the last twelve months, has shown how this obnoxious impurity may be influenced by different methods of purification; for in the case of common gas, the average proportion of sulphur in the gas from the Great Central Works has only been 12.91 grains per 100 cubic feet, whereas in the gas of the Chartered Company it has ranged from 21.41 grains to 28 59 grains per 100 cubic feet—the average for all the stations of that company being 14.77 grains, and of the City Company 19.75 grains. And again, although the average amount of sulphur in the Cannel gas of the City Company has been but 10.29 grains per 100 cubic feet it has reached to an average of 24.48 grains in that of the Chartered Company. These large differences are, according to Dr. Letheby, entirely owing to the different methods of purification, and he directs attention to it, as a matter of great practical importance.

The other impurity, ammonia, has been always absent from the common and the Cannel gas of the City Company, but it has been frequently in the gas of the other companies, averaging 0.88 of a grain per 100 cubic feet of the Great Central gas, and from 1.87 to 3 68 grains in that of the gas from the different stations of the Chartered Company; in fact, it has exceeded the prescribed amount of grains per 100 cubic feet, on seven occasions, in the Chartered gas at Leadenhall Street, and on nine occasions in the same company's gas at Gray's Inn Lane.—*Chemical News, July*, 1870.

The Philadelphia Water Works—Their Present Condition.

Since last summer a number of improvements have been made to the Philadelphia Water Works, which will inccease the supply of water to certain portions of the city. The new Cornish engine, at the Schuylkill Works, which was put in operation early this year, is now pumping about 8,000,000 gallons per day. This engine, with the others in use at these works, pump about 18,000,000 gallons per day, an increase of 7,000,000 per day, as compared with the period of drouth last summer. A larger engine, of the same pattern, which will be capable of pumping about 10 000,000 gallons per day, and will be completed next March.

At the Fairmount Works, the second large turbine wheel built in the place of the old breast wheels is completed, and now pumping about 8,000 000 gallons per day. A contract was made some time since for the third turbine wheel, and the work has been commenced but will not be completed until next year. When this work is finished, but two of the old breast wheels will remain

One section of the new reservoir at Belmont, to supply West Philadelphia, has been completed, and in a few days will be filled with water, the new engine at the new works, near Belmont Cottage, having been finished. The capacity of this engine and pump is 5 000,000 gallons per day. As soon as the second engine for these works is built and put in place, the old engine house near Girard avenue will be abandoned.

In about six weeks it is expected the repairs to the reservoir at Roxbourough will be completed, and also the bridge over the Wissahickon, which is to convey the water for the supply of Germantown. This bridge, which is formed by two lines of twenty inch water main, will be 684 feet long, divided into four spans, the highest pier, 94½ feet high, and made of wrought iron pipes eight inches in diameter, and braced with wrought iron ties. The water pipe on each side of the creek has already been laid, and as soon as the bridge is completed, water will be supplied to the reservoir at Mount Airy from the Roxborough reservoir. There are two engines with a pumping capacity of 6,000,000 gallons per day at the Delaware works. A new engine, with the capacity equal to the two old ones, is now being constructed, and a new reservoir built at Sixth street and Lehigh avenue. The engine and reservoir will be completed next summer.—*U. S. R. R. and Mining Register, July*, 30.

The New Patent Law.

A copy of the "Act to revise, consolidate, and amend the statutes relating to Patents and Copyrights" approved by the President, has been forwarded to us. It repeals all the acts—25 in number—passed at various periods from 1836 to 1869, relating to patents, yet makes no radical change, either in the system of granting or in the tenure of patent rights. Herewith we present a summary of its chief features:

The officers provided are a Commissioner, Assistant Commissioner, three Examiners-in-chief, Chief Clerk, Examiner-in-Chief of interferences, twenty-two Principal Examiners, twenty two Assistant Examiners, Librarian, Machinist, five clerks, class 4; six clerks, class 3; fifty clerks, class 2; forty five clerks, class 1; and purchasing clerk.

Additional clerks, male and female, copyists, etc., *ad libitum*, or according to necessity.

The claims and engravings to be no longer published in the report. The annual report to contain only a list of the patents.

The three Examiners-in-chief required to be persons of competent legal knowledge and scientific ability.

No other persons connected with the Patent Office required to have such qualifications.

Models to be furnished when required by the Commissioner.

The printing of the patents and drawings is authorized, and we trust that the Commissioner will make the work creditable to the advancad state of American art and invention

All persons may take patents provided the invention has not been in public use for more than two years.

No discrimination is made against Canadians. The law requiring foreigners to put their inventions on sale within eighteen months is abolished.

Assignments void, as against a subsequent purchaser, unless within three months from date.

All cases can be appealed from the Commissioner to the District Court, except interference cases.

In cases where a patent is refused by the District Court, an appeal by bill in equity may be taken.

Disclaimers may be filed.

Designs may be taken by all persons—no discrimina

tions. This will enable foreign manufacturers to protect themselves against having their designs copied, which has hitherto been quite extensively practised in this country, especially in the production of textile goods.

Trade marks may also be protected by firms or individuals, $25 for thirty years, with right of renewal

The above are the more important changes made by the new law. They are simple, and on the whole commendable.

Brooklyn's Water Supply.

Surveyors are now engaged in surveying the ground at Hempstead, which the Water and Sewerage Board propose to take for the new storage reservoir. Recently the President of the Board, Mr. William C. Fowler, together with his Chief and Assistant Engineers, Col. Adams and Mr. Bergen; General Slocum, Senator Norton, William D. Veeder, Surrogate; Thomas Gardner, County Treasurer, and several other gentlemen, went over the ground, or at least around the three ponds which the Commissioners propose to convert into the storage reservoir, the appropriation for which was authorized by the last Legislature. The daily consumption is now 30,000,000 gallons, while the supply is only at the present time 20,000,000. This excessive consumption has existed but a short time, and the demand will decrease as soon as the heated term has passed. The average consumption is over 18,000,000 gallons per day. It will take two years to complete the new reservoir, and there will be by that time four or five million gallons per day more required. Mr. Kirkwood, an engineer who has been investigating the resources, says that there is an excess of 24,000,000 gallons daily running to waste in Hempstead valley. The new reservoir takes in about 300 acres, 240 of which will be converted into a water area. It is to be a mile and a half in length and a half a mile in width. Its capacity will be equal to 1,055,000,000 gallons. The cost of the work will be $1,400,000.

"Defect in Steam Engines."

Zealous professors of science occasionally call attention to the fact that steam, as a motor, costs much more than it should, and that little over the actual heating value of the fuel is realized in practice.

Experiments and experience prove the statements to be virtually correct, and it is a reproach to the mechanical skill of the period that it should be.

The loss is not in the theory of the engine, for that is perfect, but in the practice of that theory; or, in plain terms, in the construction of steam engines. It is an undeniable fact, however, that but few of the steam engines now constructed work with the economy that they should, or even approximate in performance to the theoretical value of the fuel.

Portable engines are turned out by scores which although well enough externally, are far from being in a healthy condition in those parts which affect economy. The slide valves are only such in name; they exercise few of the proper functions of this most important detail, and the boilers are heavy, enormously large in fire and heating surface, and every way disproportioned to the size of the cylinders. The feed pumps are poorly got up; the valves lift too much; the water passages are cramped and crooked, and the absence of any proper method for heating the feed water without creating more loss from back pressure on the piston than is gained by injecting hot water into the boiler is often noticeable. We make these statements for the interest of any it may concern, not to find fault. Many stationary engines are in precisely the same condition.

It is not the only thing in a slide valve that it shall open and close the ports at a certain time, but that it shall be properly set for the work it has to do, that it shall exhaust the contents of the cylinder at the proper time, that it shall close properly, and that the lead shall be proportioned to the duty. That this is important every one is aware who has ever inspected, or is familiar with, indicator diagrams.

We know that engines are often regarded as in chronic or incurable difficulties, because some mysterious cause conflicts with setting the valves properly, but we have frequently found that individuals were more fond of declaring that the defect was very mysterious, than that they were zealous to remedy it.

It is very plain, from the simple facts here cited, many of which are so well known among professional engineers as to be truisms, that one of the greatest obstacles in the way of economy in the steam engine is a want of mechanical accuracy in construction, erection, and oversight; and that the cost of a horse-power could be very much reduced by attention to obvious and well-known defects existing in steam-engines.—*American Engineer.*

Lightning Rods.

Some weeks ago the question came to us, "Should lightning rods be insulated?" Seeing a controversy just then going on in several papers respecting protection from lightning in general, we made no reply. Now that the discussion has ceased, it seems hardly necessary. Yet we dissent from two formidable authorities on the point presented to us.

Prof. Henry says he regards insulation unimportant. The *Technologist* regards it as an injury. We deem it not in every case essential, yet a guard which prudence would lead a careful man to adopt.

1. The iron eyes which support a rod when made to pierce a wall, are powerless in leading lightning thereto when the rod is well grounded, and the wall itself dry. But a wall built of porous stone, or unhardened brick, absorbs moisture, and becomes a conductor larger than the iron rod, in the proportion of its absorbent ability, or, more correctly, to the moisture it has absorbed. To such a wall the iron support gives an introduction which an insulator might prevent. The escape of the current of a battery down damp walls, so well known to operators, is sufficient illustration of the point we state.

2. Although we would, from motives of prudence, use insulated supports, they are rendered less necessary as increased care is taken in grounding and jointing the rod. Some operators take no pains with their ground wires, forgetting that their value depends, as do lightning rods, upon connection with the permanent moisture of the earth. Without this ground connection touching permanent moisture, lightning rods had better be removed altogether, and no insulation will render them safe.—*Journal of the Telegraph.*

The Coal Trade Sale.

EIGHTY THOUSAND TONS DISPOSED OF—MATERIAL ADVANCE IN PRICES.

The Delaware, Lackawanna and Western Railroad Company sold at auction, July 27, 80,000 tons of Scranton coal. The attendance was large, but the bidding was not very animated. A general improvement over the prices obtained at the sale last month was realized, notwithstanding the impression then existing regarding a scarcity has been removed. There are said to be 1,000,000 more tuns now on hand than was the case last year at this period. High prices during the coming fall and winter are not anticipated, inasmuch as the laborers at nearly all the mines are at work at satisfactory terms. The following are the quantities sold and average prices realized:—

	Tons.	
Lump	12,000	$4.20 a $4.37½
Steamboat	10,000	4.45 a —
Grate	16,000	4.87 a 4.95
Egg	10,000	5.00 a 5.02½
Stove	20,000	5.50 a 5.62½
Chestnut	12,000	4.40 a 4.50

Comparing with the prices of last month as follows:

	Tons.	
Lump	11,000	$4.80 a 4.07½
Steamboat	12,000	4.15 a —
Grate	15,000	4.57 a 4.67½
Egg	10,000	4.65 a 4.70
Stove	20,000	5.10 a 5.25
Chestnut	12,000	4.30 a 4.35

Showing an average increase in lump of 25c. per tun, in grate of 29½c., in egg of 33½c. The bulk of the egg at 85, of the stove at $5 50 and of the chestnut at $4 40

Recent American Patents.

Pertaining to the Specialties of this Journal, for the two weeks ending August 13, 1870.

105,626.—Steam Generator.—Nelson H. Barbour, New York City. Antedated July 19, 1870.

105,640.—Steam Heater.—B. F. Campbell and Charles Whittier, Boston, Mass.

105,642.—Steam Generator.—John Carroll, Detroit, Mich.

105,644.—Water Wheel.—G. H. Jones, Rose, N. Y.

105,698.—Water Wheel.—Alfred Kneass, Northumberland, Pa.

105,712.—Water Wheel.—George Miller, Providence, R. I.

105,756.—Gas Apparatus for Railroad Cars, Etc.—J. S. Wood (assignor to himself and John J. Carberry), Philadelphia, Pa.

105,757.—Gas Apparatus for Railroad Cars, Etc.—J. S. Wood (assignor to himself and John J. Carberry), Philadelphia, Pa.

105,768.—Gas Burner.—J. F. Barker, Springfield, Mass.

105,808.—Case for Turbine Water Wheels.—J. O. Joyce, Dayton, Ohio.

105,810.—Vapor or Gas burner.—John C. Love, Philadelphia, Pa.

105,841.—Steam Engine Governor.—Wm. H. Place, New York City.

105,847.—Steam Governor.—A. F. Reeder Normal, Ill.

105,911.—Extension Gas Fixture.—H. Coester, New York City.

105,929.—Turbine Water Wheel.—Enos Emerson, Smithport, Pa.

105,954.—Water-Pipe Mold.—Henry Knight, Brooklyn, N. Y.

105,971.—Apparatus for Automatically Regulating the Flow of Gas Used in Heating Vulcanizers, Etc.—J. M. Osgood (assignor to himself and Flagg & Osgood), Somerville, Mass.

105,994.—Apparatus for Carburetting Air.—J. F. Spence, Brooklyn, N. Y.

106,061.—Rotary Pump.—R. A. Horing, Denmark, Ill.

106,070.—Gas Heating.—John Lundgren, New York City

106,072.—Pump C. L. Merrill, Watertown, N. Y.

106 103.—Meter.— George Sewell, Brooklyn, N. Y.

MISCELLANEA.

Large Engine Shafts.—Two immense shafts arrived at the Bethlehem (Pa.) depot, the other day, *via* the North Pennsylvania Railroad, direct from the machine shop, Philadelphia, intended for the gigantic engine at the zinc mines at Friedensville, said to be the largest machinery erected for pumping water in the world. These shafts each weigh 16,412 pounds, or over sixteen tuns the two. It was necessary to use a span of eighteen mules and a wagon of extraordinary size, to convey each singly to the place of destination, which was effected without delay or accident.—*Am. Artisan.*

The Works for the Citizen's Gas-Light Co. of Newark, are being built by the Atlantic Dock Iron Works, at South Brooklyn. The retort house has a capacity of 800,000 feet per diem. It is fire-proof; the gasometer will hold about 300,000 feet. These works will have all modern improvements. The firm are extensive contractors in their line, and are also building the works of the New York Mutual Gas Company.

The Fall River Gas Company have finished a gasholder with a wrought iron guide frame. The tank is 75 feet in diameter and 21 feet high, with a capacity of holding 100,529 cubic feet of gas. The number of cubic feet of gas manufactured the past year, by this company, was 21,000,000. They commenced operations in 1840. Wm. B. Durfee is the superintendent.

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It has been for many years very extensively used by various Gas companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizens' Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and Providence Gas Light Company, Providence, R. I.

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DESPARD COAL

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Mines in Harrison County, West Virginia.
Wharves, Locust Point, / Company's Office, 29 South street } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine.

*** Reference to them is requested. 204-1y

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The orders of Gas Companies solicited. 238-tf

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THE ADVANTAGES OF THIS PATENT POST over the old style, are as follows:

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2d. When the old style of post is broken, the bottom piece has to be dug out, which cannot be done in winter, or in wet weather: all this is obviated in this Post, as no digging is required. This style of Post is especially desirable when flag stone sidewalks are used.

3rd. When a stoppage of gas in stand pipe occurs, the column can be lifted out, the pipe detached, cleaned, and replaced in fifteen minutes; no digging being required as is now done with the old Post.

4th. A lighter and better casting can be made from this patent, and it can be handled better, owing to its length and lightness.

5th. In case a broken column cannot be repaired, one third of the original cost is saved by the base being secured and perfect.

Rights for States, or the United States, on reasonable terms. Address, Editors Gas-Light Journal, 42 Pine street, N. Y.

Certificate.

St. Louis, September 1, 1863.

I have examined a new Lamp Post, the Branson patent, and unhesitatingly pronounce it to be the best thing of the kind I have ever seen. Posts of this description have been erected in this city, and in my opinion this style of Post should be universally adopted. As I believe it possesses all the advantages claimed for it.

The St. Louis Gas-Light Company have adapted this Post and ordered a large quantity for immediate use.

THOMAS PRATT,
587-6m Sup. St. Louis Gas Works.

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Refer to the Manhattan Gas Light Company, New York, and the New York Gas-Light Company, New York.

HIRAM BENNER, Sec'y and Treasurer. A. N. MEYLERT, President.
246

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AND

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EDITORS AND PROPRIETORS.

Consulting Chemist,

Geologist and General Scientist,

PROFESSOR HENRY WURTZ.

[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

TUESDAY, AUGUST 16, 1870.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these objects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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GENERAL EDITORIAL.

NEW AND OPPOSITION GAS-LIGHT COMPANIES.

THE HAGERSTOWN GAS LIGHT CO., MD., are commencing extensive alterations, and enlarging their works, including a new gasholder. Messrs. Morris, Tasker & Co., of Philadelphia, have been awarded the contract to make the new improvements.

Opposition gas companies are becoming to be quite popular now-a-days, so it would seem, not only in our large cities, but in smaller towns.

AN OPPOSITION GAS LIGHT CO. has been organized in Memphis, Tenn. We doubt not the astute and intelligent manager of the old company, Mr. Fitch, is equal to the occasion.

CHICAGO, ILL., has an Opposition Gas Company, which was successfully established some time ago, by one of our enterprising New York millionaires, Commodore H. K. Garrison.

CLEVELAND, OHIO, has also an opposition Gas-Light Company, which has been in operation about two years.

PITTSBURGH, PA.—This city is in the heart of the coal region, and gas is supplied to consumers at a less price than any other city in the Union. It seems, however, that even there, the margin of profit is not so little, but a rival gas company—East Pittsburgh Gas-Light Company—has lately been organized, and the stock paid up sufficiently to commence the erection of the new works. It is intended to turn on the gas this fall.

SAN FRANCISCO.—This city has also been blessed with a rival gas company, which was no blessing at all, in fact, because the old company bought out the new, and then and there the enterprise came to an ignominious end. This was several years ago. At the present time, a new gas company has been organized, we understand, and is in a fair way to succeed—in *pipe laying* and *gas making!*

BALTIMORE, MD., has a new Gas-Light Company, fully organized, and the works are being built with unusual energy and despatch.

PHILADELPHIA, PA., has three gas works, but only one private company—the Northern Liberties Gas-Light Co. The Old City Gas Works, and the works at Point Breeze are public works, owned and managed by the city corporate authorities, *pro bono publico*.

NEWARK, N. J., has an opposition Gas-Light Company, now engaged in erecting new works upon a large scale. The contractors who are doing the work are Messrs. Hoy, Kennedy & Co., of this city.

BROOKLYN, N. Y.—The original City Gas-Light Company of Brooklyn, had a competitor known as the Citizen's Gas-Light Co., several years ago. After much and unprofitable competition, they agreed upon a division of territory, and an adjustment of their differences, since that time matters have gone smoothly. This amicable arrangement was the result of the good sense and business foresight of President Augustus Benson of the City Company on one side, and President W. P. Libby of the Citizen's Gas-Light Company, on the other side. Recently, however, some Wall street capitalists have decided to go into a legitimate and public spirited enterprise, and to this end have organized the People's Gas-Light Company, of Brooklyn, and are erecting works near Wallabout Bay. Originally, we believe, it was intended as an opposition to the existing gas companies; but former experience doubtless, taught the old companies wisdom, and a compromise has finally been made with the new company, which is mutually satisfactory.

Several of our smaller towns get the *opposition* fever now and then, but we have not space to enumerate them at this time.

Of our cities that can afford new gas-light companies, none can compare with New York in number or magnitude; nowhere in the civilized world is there so much gas consumed, *pro rata*, according to population, or the profits of the gas companies so large; nowhere has the value of gas stock increased so largely, in comparison to the cash capital invested. Hence it is doubtless that

NEW YORK CITY having already four companies in active operation, is determined to have still another—the Mutual Gas-Light Company. Some of the heaviest capitalists in New York are in the directory of this organization, and evidently mean business. Land for the erection of works has been purchased at East 42nd street, and Messrs. Hoy, Kennedy & Co. have completed plans for the works, and are already engaged in erecting the same. The plans and specifications for originality of design, and completeness of detail, excel anything of the kind we remember to have seen.

At the late annual election, held May 18th, for directors of the New York Mutual Gas-Light Co., the following gentlemen were elected directors for the ensuing year: James Hoy, Cornelius Vanderbilt, Cornelius K. Garrison, William M. Tweed, Andrew V. Stout, Cornelius Vanderbilt, Jr., Richard B. Connolly, Peter B. Sweeny, Nicholas B. La Bau, William E. Hoy, Joseph Seligman, Hugh Smith, Albert H. Vernam, Geo. W. McLean, Geo. Opdyke, George J. Forest. At a subsequent meeting of the Board of Directors James Hoy, Esq., was elected President, and William E. Hoy, Esq., Treasurer of the company; Chas. Place, Secretary.

The above list of names comprises an array of combined capital and practical business capacity, which is an assurance beyond question, that the new enterprize will be a success, in whatever manner they decide to carry on the manufacture of gas. But if the managers, and the Board of Directors will carefully examine, and adopt some of the late improvements in gas manufacture, and not follow in in the worn out non-progressive rut of fifty years ago, their success will be doubly assured; and to this end we would suggest that they examine the new process of Messrs. Brown & Co. now operating so successfully at Saratoga.

THE NEW PROCESS OF GAS MANUFACTURE.

Owing to the numerous and various letters of inquiry we have received from different quarters, regarding the new process of gas manufacture now operating at Saratoga, N. Y., known as the Brown & Co. process, which we gave a history of in the GAS-LIGHT JOURNAL of July 16th; it seems necessary and proper to refer to it again, somewhat more in detail, in order that certain points may be more fully and unequivocally understood.

OTHER IMPORTANT QUESTIONS ANSWERED.

It is safe to say, that where the coal is transported an equal distance with petroleum, the cost of the gas by this process, will not be over one-half the cost of coal gas.

The annoyance, labor, and expense of purification is avoided, as there are none of the sulphur compounds and ammonia, or other impurities, usually to be found in coal gas.

No "gas carbon" or incrustation, forms in the retorts, as only the hydro-carbon vapor enters them, consequently the retorts are more durable and do not require to be "*burned out.*"

The labor account is reduced to about *nil*—four men will make 800,000 cubic feet per day.

The ordinary coal gas works can be altered for this process with trifling expense, and without interrupting the daily manufacture of gas. When altered, the gas from either petroleum or coal can be made at pleasure.

The cost of new works, adapted to this proceas, is not over one-fourth the cost of coal gas works

NEW PROCESS.

It is a "new process," fundamentally so, inasmuch as it converts hydrocarbons, or carbonaceous matter into a fixed gas by a new method—that is. the naphtha is placed in a *still* where a *comparatively low heat* is applied, until it is gradually converted into a *vapor*. This vapor is introduced through pipes into a *retort*, heated to a *red heat;* where it is *entirely* and *instantly* converted into a fixed gas, of remarkable purity and high candle power.

OTHER MATERIALS.

Other materials can be used besides naphtha. Any of the products of the oil wells, such as crude petroleum, dead oil, "still foots," etc. Any oil or oily or fatty matter may be used. In fact, all liquid, semi-liquid, or solid carbonaceous matter can be employed to make gas by this process; and the Letters Patent fuller specify and cover this ground.

It is only necessary to observe that, where the materials used do not evaporize (like naphtha, etc.) by the application of a steam coil, it is only necessary to apply a *sufficient degree* of heat through the aid of a *furnace*, that will convert the material into a vapor, in the first instance; and that this vapor (which is necessarily more or less *condensable*) shall pass into a retort heated to a temperature sufficient to convert it *all* into a *fixed gas*. This is the great novelty of the invention, and gives it the great advantage over the ordinary method of distilling either oils and other hydro-carbons, or coals and the like materials, to produce illuminating gas.

If coal is used, it first *distils*, and oil as a *condenble vapor* is eliminated, this, instead of going to make *coal tar* in the hydraulic main as usual, is passed into a red hot retort, where it becomes a true gas and nothing else. Now that which goes to make coal tar in the ordinary process of making gas, is the *oil* of the coal, the very essence of light, when converted into gas, as it is, in the new process.

OLD AND NEW PROCESS COMBINED.

The new process can be used to great advantage, in combination with the old, or ordinary process of gas manufacture, by distilling Pennsylvania and other caking coals. Where naptha is used in the new process, a bench of five retorts will produce 200,000 cubic feet of 20 candle gas in 24 hours; or it will produce abont 130.000 cubic feet of 40 candle power. This 40 candle gas is too rich to use alone; but by combining it with the *low candle* gas made from cheap Pennsylvania or other coals, a standard quality of gas is obtained, at a greatly reduced cost. Poor and cheap domestic coals that could not otherwise be used, can, in this way be utilized, and made valuable.

Our late protective Congress have continued the tariff on

FOREIGN AND PROVINCIAL COALS,

and gas companies who depend upon English Cannel, and other foreign coals, to give a standard candle power by mixing with domestic coals, are compelled to pay a large price for the foreign coals, which largely diminishes their net profits. By using this new process in combination, we have a *perfect substitute* for these expensive coals, and may realize a gain besides, of *from* 30 *to* 70 *per cent.*, according to the grade and cost of domestic coals used, and the proportion of naphtha employed. This consideration alone should be, and will be, we doubt not, a sufficient incentive to cause every gas company of importance in the Union, that now use foreign coal, to promptly examine this new process, as practised by the Citizens Gas-Light Company of Saratoga, N. Y.

American Institute Industrial Exhibition for 1870.

Owing to the remarkable success which attended the exhibition of the above Institute in 1869, the Board of Managers has been prompted to announce at an earlier day than usual, that the Thirty-ninth Exhibition will be held in the great structure known as the Empire Skating Rink, on the Third Avenue, 63d and 64th streets. The premises have been lately enlarged and improved, and will be opened for the reception of goods on Monday, August 29th, and on Wednesday, September 7th, the grand Exhibition will be formally opened to the public, at 12 o'clock, M., and will remain open every secular day from 9 A. M., to 10 P. M., until Wednesday evening, November 2d, 1870, when tte closing address will be delivered, and awards to successful competitors will be announced.

GAS ITEM.

We are informed that Messrs. D. S. Arnold, A. Studwell, and R. S. Buedict of Brooklyn N. Y., and J. G Brown of Saratoga Springs, have recently purchased the patents covering the new "Saratoga Process" of manufacturing gas for the City of Brooklyn and Kings County N. Y, and intend to introduce it immediately into practical operation.

These gentlemen are favorably known for their intelligence, energy, and success, in business enterprise, and we doubt not, they will reap a rich reward in this new and laudable undertaking.

Several western and other cities and towns are adopting this new method of making gas with little labor and small expense and from all we hear, it is evident the process is destined to become very popular.

GAS WORKS for SALE.—We desire to direct attention to the advertisement on editorial page, offering a gas-works for sale. It is situated but a short distance from New York, in a growing village. We do not hesitate to say that as a speculative investment, it affords an excellent chance; and for a party or parties who may desire to give it their personal attention, it is a rare opportunity to engage in a pleasant and lucrative occupation, capable of being extended. The terms, which are liberal, and other particulars, may be learned by applying to the editors of this Journal.

Answers to Correspondents.

C. J. H., of Pa.—A thorough search at the Patent Office is the only way to solve the problem. If you wish, we will undertake to do this for you, the expense of which will not be much.

G. S., of Ohio.—The numbers have been sent you by mail. Inform us at once if any copies fail to reach you in futnre.

J. S. & Co., of Minn.—You will find the names of the proper parties to address in our advertising columns. They will promptly reply to any question on the subject.

L. J. M., of Ind.—We can furnish you with the back numbers you require.

S. P., of Ill.—Pure olefiant gas may be made by heating six parts of alcohol with one part of sulphuric acid in a retort. It will require to pass through a solution of caustic potash to free it from any acidulous properties.

P. A. W., of Ky.—It is not the quantity of gas which determine the value of gas, but its illuminating power. Rosin gas has about double the illuminating power of ordinary coal gas. Albertine coal is much richer than Cannel—that is, it will yield gas of a higher illuminating power cubic foot.

NEW BOOK.

Peat Fuel: How to Make it and How to Use it. By T. H. Leavitt. 1 vol. 16mo; over 72 pages. Lee & Sheppard, publishers, Boston.

This work contains a description of an improved process and improved machinery for manufacturing fuel; also a variety of information concerning Peat fuel, its properties, uses, and value; together with opinions concerning it, as expressed by correspondents in various parts of the country, and by the newspaper press; also directions where to obtain further information, reliable and more extended, upon this subject. Some or all of which, it is presumed, will be considered worthy the attention of parties interested in the subject of cheap fuel.

Engravings for Illustrating New Inventions.

The advantages of engravings to illustrate and describe new inventions (or old for that matter) cannot be over estimated.

Descriptive circulars and bill heads, however profusely they may be scattered, can seldom give only an indefinite and obscure idea, compared to the clear and positive effect of a good engraving carefully and intelligently explained in this Journal. It then becomes a fixed item of illustrated, useful or scientific information, and reaches all parts of the United States and the world. It goes on file in our public and scientific libraries, and is preserved by all for referance; while a circular drops into the waste basket and is lost to sight and to mind.

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Patentees living at a distance, desiring to have engravings of their inventions only, or engraved illustrations, should send a small model by express (pre-paid) or mail a good photograph or pencil sketch, or a copy of letters patent, if patented. We will examine them and advise them by return mail, stating the expense. Address, M. L. CALLENDER & CO.

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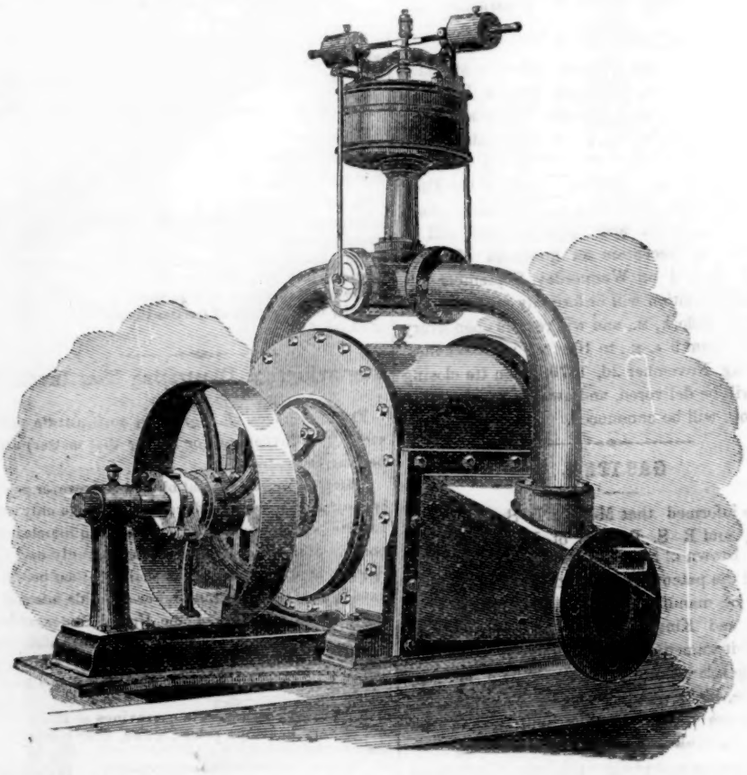

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

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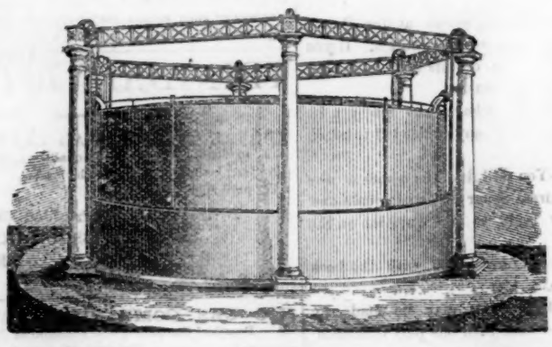

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"JOSEPH P. MAYER,
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"GEORGE LEHMAN,
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"S. A. KINSEY, Ex. Sup't.
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"I take great pleasure in saying that they give perfect satisfaction—opening easily and quickly, and requiring no effort to start them; even after they have been closed for months.
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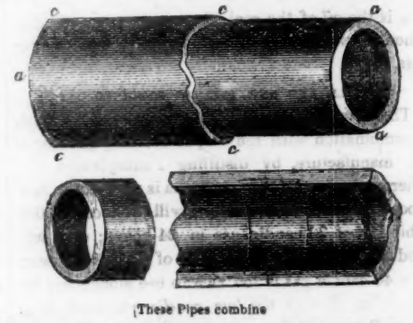

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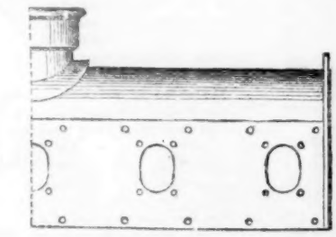

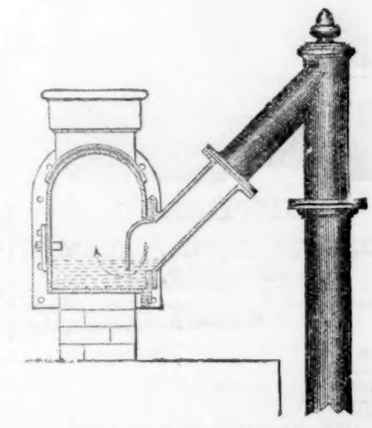

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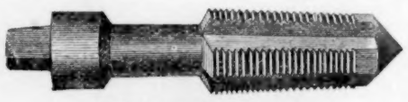

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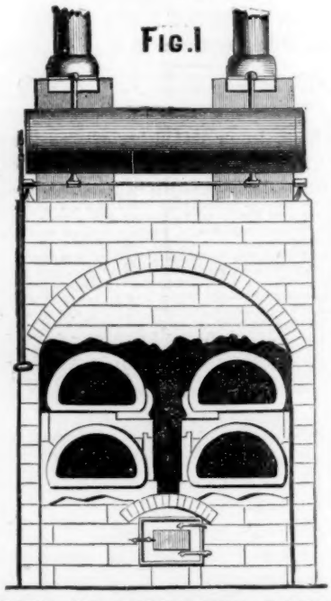

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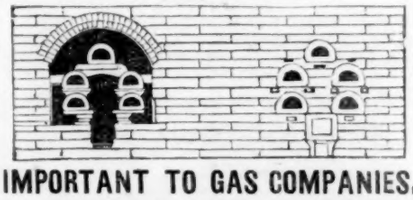

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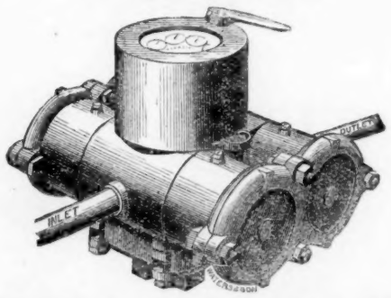

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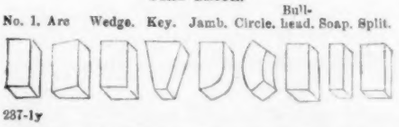

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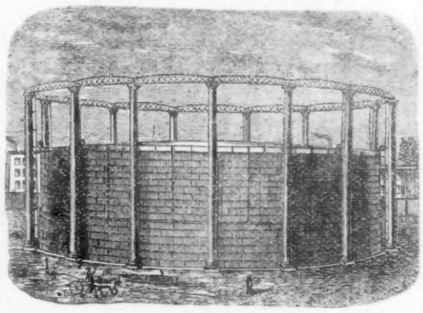

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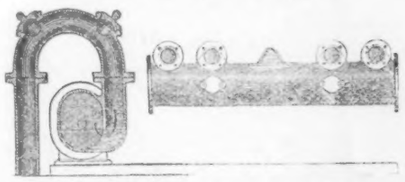

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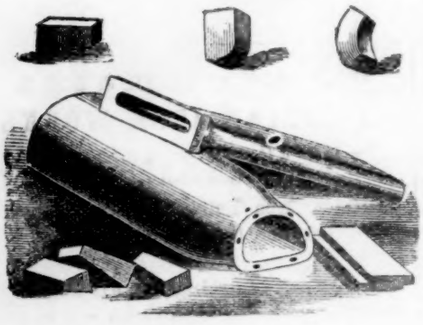

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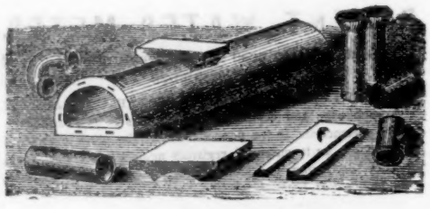

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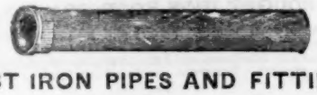

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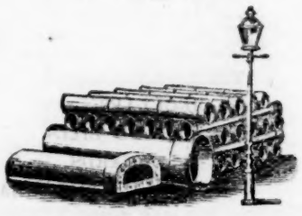

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